

In the Claims:

1. A device useful for transferring quantities of a fluid from a reservoir to a downstream component, comprising:
 - a cylinder housing having an axially extending first cylinder therein;
 - a first piston rotatably and reciprocally mounted within the first cylinder, the outer periphery of said first piston forming an interference fit with the inner periphery of said first cylinder,
 - at least one groove in the outer periphery of said first piston, said groove extending in an axial direction of said first piston, and
 - said first cylinder having an inlet port adapted to provide fluid communication between an inlet and said at least one groove when said first piston is in a first position, and an exit port spaced from said inlet port providing fluid communication between said at least one groove and an outlet when said first piston is rotated to a second position, and said piston moves to drive fluid out of said outlet.
2. The device according to claim 1, wherein said first cylinder is a bore within an injection molded body of a polymeric material.

3. The device according to claim 1, wherein said at least one groove is a rectangular groove approximately 0.005 inch deep and approximately 0.010 inch wide.

4. The device according to claim 1, wherein:
a first one of said at least one groove is formed in the outer periphery of said first piston at a first circumferential position, and
a second one of said at least one groove is formed in the outer periphery of said first piston at a second circumferential position different from said first position.

5. The device according to claim 4, wherein:
said first and second grooves are offset relative to each other in the axial direction of said first piston.

6. The device according to claim 1, wherein said first piston is stepped with a larger diameter portion of said first piston fitting within a larger diameter portion of said first cylinder, and a smaller diameter portion of said first piston fitting within a smaller diameter portion of said first cylinder.

7. The device according to claim 6, wherein said at least one groove is formed in the outer periphery of said smaller diameter portion of said first piston.

8. The device according to claim 6, wherein said at least one groove includes an air purge groove and said larger diameter portion of said first piston and said larger diameter portion of said first cylinder define a first volume in fluid communication with said air purge groove when said air purge groove is in fluid communication with said exit port.

9. The device according to claim 1, further comprising:
a second piston coaxial with said first piston and having a larger outer diameter than said first piston, said second piston forming a sleeve over the outer periphery of said first piston and being reciprocally mounted within a second cylinder in the cylinder housing, said second cylinder having a larger inner diameter than said first cylinder.

10. The device according to claim 9, wherein one end of said second cylinder forms a shoulder adjacent one end of said first cylinder, with a volume being defined between said shoulder and said second piston, when the second piston is spaced from the shoulder and said volume being in fluid communication

with an air purge groove when said air purge groove is in fluid communication with said exit port.

11. The device according to claim 10, wherein said at least one groove comprises first and second grooves, the first groove being in the outer periphery of said piston at a first circumferential position, and the second groove being in the outer periphery of said piston at a second circumferential position different from said first position.

12. The device according to claim 11, wherein downstream ends of said first and second grooves are offset relative to each other in the axial direction of said piston.

13. The device according to claim 1 in combination with a reservoir containing a liquid having medicament therein and an aerosol generator comprising a heated capillary flow passage located downstream of the exit port.

14. A piston pump for pumping fluid from a reservoir to a downstream component, said piston pump comprising:

a piston mounted rotatably and reciprocally within a cylinder, said piston having a larger diameter portion fitted in a larger diameter portion of said cylinder, and a smaller diameter portion fitted with an interference fit within a smaller diameter portion of said cylinder,

said piston having a first fluid groove formed in an axial direction of said piston along the outer periphery of said smaller diameter portion of said piston at a first circumferential position, said first fluid groove extending from an end of said piston part way along the outer periphery of said piston, and

said piston further including a second fluid groove formed in an axial direction of said piston along the outer periphery of said smaller diameter portion of said piston at a second circumferential position different than said first circumferential position and at least partially offset in the axial direction of said piston from said first fluid groove, the second fluid groove comprising an air purge groove.

15. The piston pump according to claim 14, wherein

an inlet port adapted to be in fluid communication with a reservoir is formed into said smaller diameter portion of said cylinder at a first circumferential position, and an exit port in fluid communication with a downstream component is

formed into said smaller diameter portion of said cylinder at a second circumferential position,

said first fluid groove providing fluid communication between said inlet port and said smaller diameter portion of said cylinder during a suction stroke of said piston, and between said exit port and said smaller diameter portion of said cylinder during a dispensing stroke of said piston, and

said second purge groove providing fluid communication between a compressed gas chamber formed between said larger diameter portion of said piston and said larger diameter portion of said cylinder, and said exit port, when said piston is flush against one end of said smaller diameter portion of said cylinder and said first fluid groove is aligned with said inlet port.

16. The piston pump according to claim 14, wherein said larger diameter portion of said piston is integral with said smaller diameter portion of said piston.

17. The piston pump according to claim 14, wherein said larger diameter portion of said piston is a sleeve that is fitted over the outer periphery of said smaller diameter portion.

18. The piston pump according to claim 14, wherein said piston includes an extension having at least one lug, and a barrel cam is provided for rotation about an axis perpendicular to the central axis of said piston, said barrel cam including at least one cam groove around its outer periphery with said at least one lug being engaged with said at least one cam groove, and said barrel cam further including an eccentric portion wherein the eccentricity of said eccentric portion is substantially equal to the desired stroke of said piston.

19. The piston pump according to claim 18, wherein:
a cam plate is provided in contact with said piston extension on a surface of said piston extension opposite from said at least one lug, said cam plate being rotated by the rotation of said barrel cam such that a thicker portion of said cam plate contacts said piston extension when said at least one lug is engaged with said at least one cam groove at a region of the outer periphery of said barrel cam other than at said eccentric portion, whereby said piston is driven in a first axial direction by said eccentric portion of said barrel cam and in the opposite axial direction by said cam plate.

20. The piston pump according to claim 19, wherein a first miter gear is fixed to said barrel cam for rotation with said barrel cam around the central axis

of said barrel cam, and a second miter gear fixed to said cam plate is engaged with said first miter gear for rotation about an axis perpendicular to the central axis of said barrel cam.

21. The piston pump according to claim 14, wherein said larger diameter portion comprises an annular groove positioned radially inward from the outer diameter of the larger diameter portion and defining a flexible annular flap or lip seal around the outer periphery of the larger diameter portion.

22. A method of delivering a quantity of a fluid from a fluid source to a downstream component, comprising:

drawing a quantity of the fluid through an inlet port into a cylinder by translating a piston from a position wherein an end of said piston is flush against an end wall of said cylinder, said piston comprising a fluid groove extending in the axial direction of said piston from said end of said piston and in fluid communication with said inlet port;

rotating said piston within said cylinder to bring said fluid groove out of alignment with said inlet port and into fluid communication with an exit port from said cylinder; and

translating said piston toward said position wherein said end of said piston is flush against said end wall of said cylinder to dispense said fluid from between said end of said piston and said end wall of said cylinder, and from said fluid groove, out of said exit port.

23. The method according to claim 22, further including:

rotating said piston in said position with said end of said piston flush against said end wall of said cylinder to bring said fluid groove back into fluid communication with said inlet port, and to bring a second, circumferentially spaced axial groove on the outer periphery of said piston into communication with said exit port, said second groove providing fluid communication between said exit port and a compressed gas chamber.

24. The method according to claim 23, wherein said compressed gas chamber is defined by a larger diameter portion of said piston fitted within a larger diameter portion of said cylinder, and translation of said piston during dispensing of said fluid from said exit port causes compression of a gas within said compressed gas chamber.